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Final Technical Report

Title: Borehole Strainmeter Array Installation – Southern California:
Collaborative Program with USGS

PI: Alan T. Linde, Carnegie Institution of Washington.

This proposal was for installation of two borehole strainmeters in southern California but funding was granted only for one installation. Gladwin (CSIRO, Australia) was also funded for one site using his 3 component instrument and we worked closely in site selection so that the sites together provided complementary data,

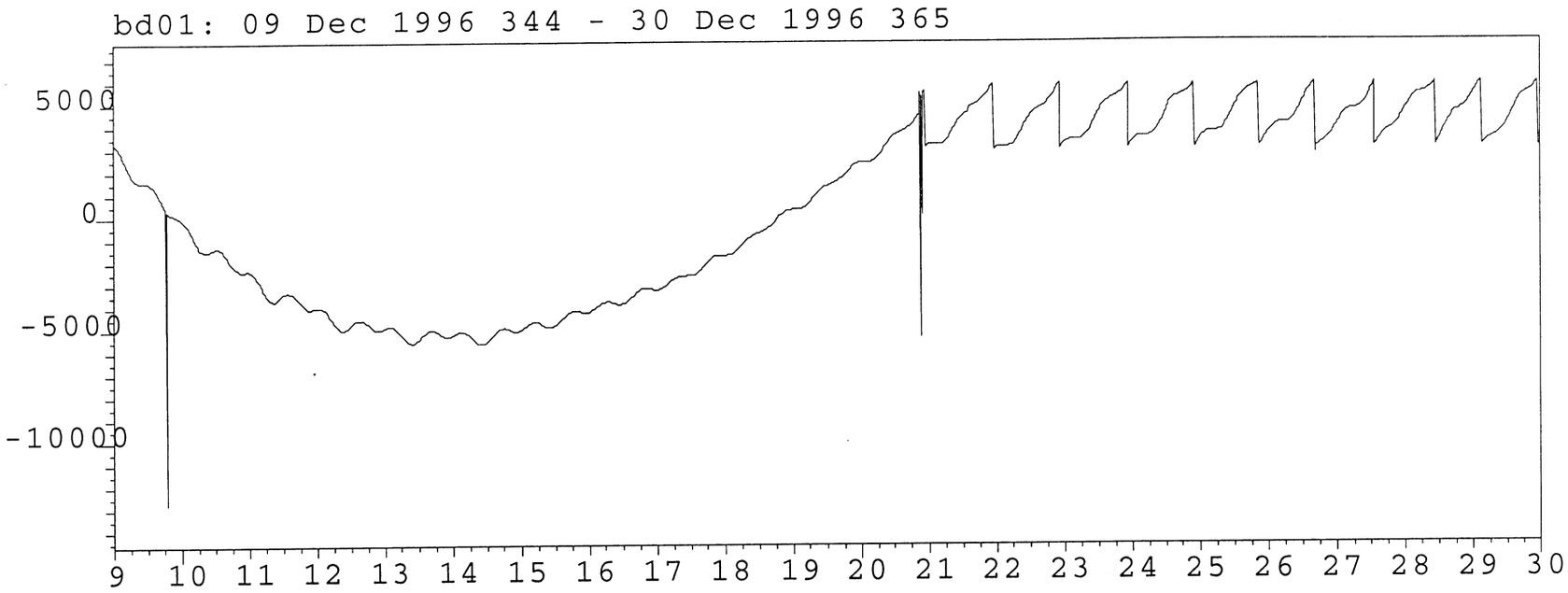
Our strainmeter was installed in late 1996 at a site close to the Big Dalton reservoir near the Sierra Madre and San Andreas faults. Gladwin's site is close by and both are not too distant from an earlier site (Punchbowl) close to the San Andreas fault. The local rock is granitic and relatively unfractured for rock so close to active faults in California. The strainmeter is installed in a borehole about 200m deep and is well bonded to the rock wall by virtue of being immersed in a cement grout which expands as it cures.

The instrument has been operating continuously since then with continuous data being sent via satellite to the USGS Menlo Park campus every 10 minutes. Our instruments are designed to operate with relatively little routine maintenance and to continue to provide data indefinitely; many such instruments have been working continuously for 20 years and all instruments installed during the last 13 years are still operating at their initial capabilities.

The attached figure shows raw unedited data (in counts of the analog to digital converter) from the strainmeter very soon after installation (top) and recently (bottom). Note that the solid earth tides are clearly recorded from the beginning. The initial slow changes (about 10 days) result from temperature changes due to the exothermic curing of the grout. Apparent vertical steps are automatic resets of the sensing system. The decreasing frequency of these steps is standard for such borehole installations and results from a slow relaxation of the ambient strain field following hole drilling. (A few spikes, due to transmission errors, are also obvious.) Standard processing of these data includes removal of the spikes and resets and of strain changes which result from changes in atmospheric pressure, which is also monitored. Data are converted into strain by calibration using model calculations of the amplitudes of the solid earth tides as reference.

The current status of the instrument is that it is operating as designed; the instrument is very well connected to the surrounding rock and the data obtained are of the highest quality.

This program is a long term one (although we have no request for continuing support from the NEHRP program) in collaboration with the USGS and the CSIRO group. We will continue to monitor the data from this site and evaluate the data together with all other available relevant data, including seismic activity and other deformation data (particularly from GPS measurements). Scientific return from this program is not expected over a short term of a few years. The value of these data may not be apparent for a number of years until we have accumulated much more data or until episodes of tectonic deformation (similar to those we have observed in other areas of California) are recorded. In such an instance we will have the potential to investigate the nature of deformation on the active seismogenic faults with otherwise unavailable capability.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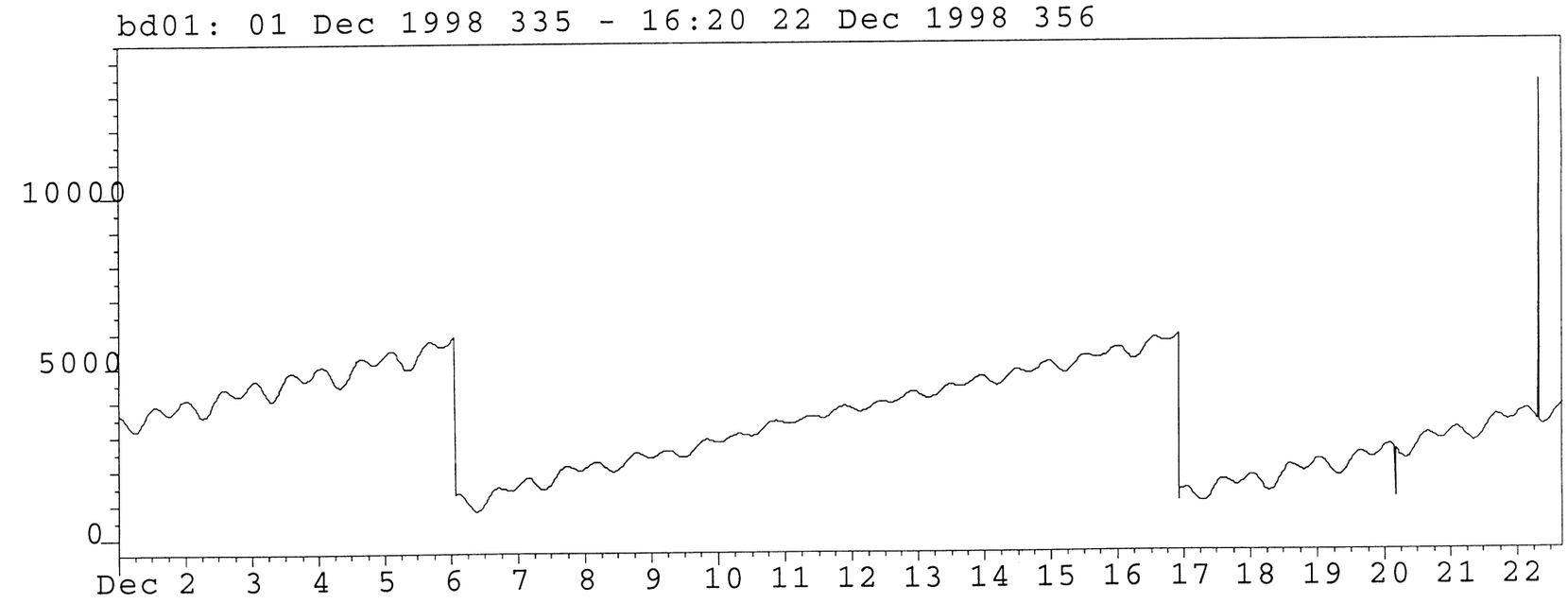
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